Application No. 10/645,349
Reply to Office Action of April 14, 2006

THE CLAIMS

Claims 1-33 are pending in the instant application. The Applicants request reconsideration of the claims in view of the following remarks.

Listing of claims:

1. (Previously presented) A method for processing a signal received by an antenna array comprising:

receiving M replicas of the signal, each of the M replicas being received by one of a corresponding M physical antenna elements of the antenna array;

determining M responses of the M physical antenna elements to the signal, each of the M responses corresponding to one of the M physical antenna elements;

and

generating, as a function of the responses of the M physical antenna elements to the signal, N responses to the signal, respectively associated with N spatial locations along the antenna array, wherein at least one of the N spatial locations is not coincident with a location of any of the M physical antenna elements and is placed at a non-equidistant location between two successive physical antenna elements.

2. (Original) The method of claim 1 wherein N - M responses of the N responses are associated with virtual antenna elements located among the physical antenna elements.

Page 3 of 18

Application No. 10/645,349
Reply to Office Action of April 14, 2006

3. (Original) The method of claim 2 wherein at least one of the N - M responses is generated by interpolating at least two of the M responses.

4. (Original) The method of claim 2 wherein at least one of the N - M responses is generated by extrapolating from at least two of the M responses.

5. (Original) The method of claim 1 including:

down converting the M replicas of the signal from radio frequency (RF) to baseband prior to the determining the M responses of the of the M physical antenna elements.

6. (Original) The method of claim 1 wherein the determining includes calculating M physical weighting parameters, wherein the response of each of the M physical antenna elements is determined as a function of a corresponding one of the M physical weighting parameters.

7. (Original) The method of claim 1 wherein the determining includes sampling each of the M replicas such that each of the M responses comprises a sample of a corresponding one of the M replicas of the signal.

8. (Original) The method of claim 1, further including:

weighting each of the N responses to the signal, thereby generating N weighted responses; and

combining the N weighted responses, thereby generating a representation of the signal.

Application No. 10/645,349
Reply to Office Action of April 14, 2006

9. (Original) The method of claim 1, wherein the signal complies with a communication protocol selected from the group consisting of: orthogonal frequency division multiplexing (OFDM), time division multiple access (TDMA), code division multiple access (CDMA), gaussian minimum shift keying (GMSK), complementary code keying (CCK), quadrature phase shift keying (QPSK), frequency shift keying (FSK), phase shift keying (PSK), and quadrature amplitude modulation (QAM).

10. (Original)   An antenna system for receiving a signal comprising:

an antenna array including M physical antenna elements, wherein the M physical antenna elements are spatially arranged to receive one of a corresponding M replicas of the signal so as to be capable of generating M replicas of the received signal; and

an array processing module including M signal processing chains, wherein each of the M signal processing chains is coupled to one of the M physical antenna elements;

wherein the array processing module is configured to generate N signal response values for the antenna array as a function of the M replicas of the received signal; wherein the N signal response values include at least one virtual antenna response value, wherein N is greater than M.

11. (Original)   The antenna system of claim 10 wherein the array processing module includes:

a weighting module coupled to the M signal processing chains wherein the weighting module is configured to calculate M physical weighting parameters as a

Application No. 10/645,349
Reply to Office Action of April 14, 2006

function of the M replicas of the received signal, wherein each of the M physical weighting parameters is associated with a corresponding one of the M physical antenna elements; and

an interpolation module coupled to the M signal processing chains, wherein the interpolation module is configured to generate the N signal response values for the antenna array as a function of the M physical weighting parameters.

12. (Original)   The antenna system of claim 11, wherein the interpolation module is configured to calculate the M signal response values as a function of the M physical weighting parameters and interpolate at least two of the M signal response values to provide the virtual antenna response value.

13. (Original)   The antenna system of claim 10 wherein the array-processing module includes:

an interpolation module coupled to the M signal processing chains, wherein the interpolation module is configured to generate the N signal response values for the antenna array as a function of the M replicas of the signal;

a weighting module coupled to the M signal processing chains wherein the weighting module is configured to calculate N weighting parameters as a function of the N signal response values.

14. (Original)   The antenna system of claim 10 wherein the N signal response values for the antenna array include M signal response values corresponding to the M physical antenna elements, wherein the virtual antenna response value corresponds to a virtual antenna element positioned within a

Application No. 10/645,349
Reply to Office Action of April 14, 2006

distance of λ/2 of at least two of the physical antenna elements, wherein λ represents a wavelength of a carrier frequency of the signal.

15. (Original)   The antenna system of claim 14 wherein the virtual antenna element is interposed between at least two of the M physical antenna elements.

16. (Original)   The antenna system of claim 14 wherein the virtual antenna element is located at an edge of the antenna array.

17. (Original)   The antenna system of claim 10 wherein the at least two of the M physical antenna elements are spatially separated by no more than a distance of λ/2, wherein λ represents a wavelength of a carrier frequency of the signal.

18. (Original)   The antenna system of claim 10 wherein the array processing module is configured to generate N signal response values for the antenna array as a function of the M replicas of the received signal by methodologies selected from the group consisting of interpolation and extrapolation.

19. (Original)   The antenna system of claim 10 wherein the signal complies with a communication protocol selected from the group consisting of: orthogonal frequency division multiplexing (OFDM), time division multiple access (TDMA), code division multiple access (CDMA), gaussian minimum shift keying (GMSK), complementary code keying (CCK), quadrature phase shift keying

Application No. 10/645,349
Reply to Office Action of April 14, 2006

(QPSK), frequency shift keying (FSK), phase shift keying (PSK), and quadrature amplitude modulation (QAM).

20. (Previously presented)A receiver system for receiving a signal comprising:

an antenna array including M physical antenna elements for receiving M replicas of the signal, each of the M replicas being received by a corresponding one of the M physical antenna elements;

means for determining a response of each of the M physical antenna elements to the signal;

and

means for generating, as a function of the responses of the M physical antenna elements to the signal, N responses to the signal, respectively associated with N spatial locations along the antenna array, wherein at least one of the N spatial locations is not coincident with a location of any of the M physical antenna elements and is placed at a non-equidistant location between two successive physical antenna elements.

21. (Original)   The receiver system of claim 20 wherein N - M responses of the N responses are associated with virtual antenna elements located among the physical antenna elements.

22. (Original)   The receiver system of claim 21 wherein the means for generating includes means for generating at least one of the N - M responses by interpolating at least two of the M responses.

Page 8 of 18

Application No. 10/645,349
Reply to Office Action of April 14, 2006

23. (Original)   The receiver system of claim 21 wherein the means for generating includes means for generating at least one of the N - M responses by extrapolating from at least two of the M responses.

24. (Original)   The receiver system of claim 20 wherein the M physical antenna elements are spatially separated by no more than a distance of $\lambda/2$, wherein λ represents a wavelength of a carrier frequency of the signal.

25. (Original)   The receiver system of claim 20 wherein the means for determining includes means for calculating M physical weighting parameters, wherein the response of each of the M physical antenna elements is determined as a function of a corresponding one of the M physical weighting parameters.

26. (Original)   The receiver system of claim 20 wherein the means for determining includes means for sampling each of the M replicas being received by one of a corresponding M physical antenna elements, wherein the response of each of the M physical antenna elements is a sample of a corresponding one of the M replicas of the signal.

27. (Original)   The receiver system of claim 20, including:

means for weighting each of the N responses to the signal to produce N weighted responses; and

means for combining the N weighted responses to produce a representation of the signal.

Application No. 10/645,349
Reply to Office Action of April 14, 2006

28. (Original)   The receiver system of 20, wherein the signal complies with a communication protocol selected from the group consisting of: orthogonal frequency division multiplexing (OFDM), time division multiple access (TDMA), code division multiple access (CDMA), gaussian minimum shift keying (GMSK), complementary code keying (CCK), quadrature phase shift keying (QPSK), frequency shift keying (FSK), phase shift keying (PSK), and quadrature amplitude modulation (QAM).

29. (previously presented) An array processing module comprising:

M signal processing chains wherein each of the M signal processing chains is configured to receive a replica of a received signal from a corresponding one of M physical antenna elements; and

an interpolation module coupled to the M signal processing chains, wherein the interpolation module is configured to generate N signal response values for the antenna array as a function of the M replicas of the received signal, wherein N is greater than M.

30. (Original)   The array processing module of claim 29 including:

a weighting module coupled to the M signal processing chains wherein the weighting module is configured to calculate M physical weighting parameters as a function of the M replicas of the received signal, wherein each of the M physical weighting parameters is associated with a corresponding one of the M physical antenna elements;

wherein the interpolation module is configured to generate the N signal response values for the antenna array as a function of the M physical weighting parameters.

Page 10 of 18

Application No. 10/645,349
Reply to Office Action of April 14, 2006

31. (Original)   The array processing module of claim 29 including:

a weighting module coupled to the M signal processing chains wherein the weighting module is configured to calculate N weighting parameters as a function of the N signal response values; and

N weighting elements configured to receive the N signal response values, wherein each of the N weighting elements weights each of a corresponding one of the N signal response values by a corresponding one of the N weighting parameters, thereby generating N weighted signal response values.

32. (Original)   The array processing module of claim 31 including:

a summing portion configured to receive the N weighted signal response values from the N weighting elements and provide a combined signal representative of the received signal.

33. (Original)   The array processing module of claim 29 including:

a down conversion portion coupled to each of the M signal processing chains, wherein the down conversion portion is configured to convert the M replicas of the received signal from radio frequency (RF) to baseband frequency.